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The People’s Republic of China has undergone a rapid and major expansion during the past twenty years in many sectors of society, as illustrated in a growth rate of over 10 percentage points within the country which is more than the growth rate of the entire world. By opening itself to other economies, China is also optimizing the world industrial structure in terms of investment and growth.

This rapid development and growth in recent years is also mirrored in the Neonatal Research and Intensive Care Departments of the Shanghai Children’s Hospital of Fudan University Hospital. As a comprehensive multi-disciplinary research university hospital, they have also in recent years established a National Neonatal Training Program to serve the People’s Republic of China, in joint venture with the Canadian Neonatal Network™. Critical Care News met with Dr Bo Sun, MD, PhD, Head of Laboratory of Pediatric Respiratory and Intensive Care Medicine at Shanghai Children’s Hospital of Fudan University, and with staff members of the Neonatal Intensive Care Unit of Shanghai Children’s Hospital to hear about the development and progress that has been made in recent years.
Bo Sun, MD, PhD, has worked for many years as head of Laboratory of Pediatric and Respiratory and Intensive Care Medicine at Shanghai Children’s Hospital of Fudan University. He has also worked for many years in research for the areas of surfactant therapy and application of nitric oxide, in Sweden as well as China. Neonatal special care services in China have been established only within the past decade, and his most recent research was conducted together with the Chinese Collaborative Study Group for Neonatal Respiratory Diseases to investigate the incidence, management, outcome and cost of neonatal respiratory failure treated by mechanical ventilation at NICUs in major hospitals in southeastern and midwestern China.

Dr Bo Sun explains: “This has been a systematic survey of 23 intensive care units in major cities in China, to investigate neonatal respiratory disease, and in particular respiratory failure which is most severe and commonly requires very extensive treatment. So there is a requirement for a high level of intensive care and respiratory support. From a total of 13,000 patient admissions, we got some 1700 cases of severe respiratory failure requiring a high level of intensive care support. We charted how these cases were treated, and in particular how the respiratory therapists used different modes of ventilation and outcome.”

The investigation by Dr Sun and his colleagues revealed that nasal CPAP was utilized in 52% of patients receiving mechanical ventilation. He states that “In different age groups and in the very premature newborns more CPAP is being used than conventional mechanical ventilation.”

In context of the major results, mortality in the group with severe respiratory failure remains very high at 35%. Dr Bo Sun explains that among those clinical results, half of the patients were withdrawn from treatment. “The major reason that they were withdrawn from treatment was economic factors. Although this data is from major cities, the population is very mobile and transient in looking for work and seasonal work and with very little opportunity for prenatal care and follow-up, and frequently with delivery at home. We find that this accounts for a very severe form of RDS and infections.”

As head of the Laboratory for Neonatal and Pediatric Intensive Care Medicine, the institution is also in the position to influence regional clinicians and therapies. Dr Sun described the operations: “We are a special research lab, but my role in a clinical aspect is for design and research coordination. For the lung disease my major work is for research, we have a separate chief who is in charge of intensive care, whom I work together with to coordinate efforts, like this one. I have another paper published by Intensive Care Medicine describing acute respiratory distress syndrome in pediatric intensive care across China, another epidemiology study. This is how we have been working for the past ten years, as well as other things such as continuing education, workshops and some symposia we have every year, domestic and internationally, so we are progressing and influencing many regional clinicians in regard to understanding and use of lung protective therapies in pediatric and neonatal patients.”

When asked about how he sees research focus in the near future, Dr Bo Sun states: “I think that the way we are organized in China, towards a close relationship with clinical works due to economic factors, among others. We are playing a role like locomotives in research; later on we wish to help participating centers to become their own locomotives in the regional areas, to conduct their own studies. Our center plays a leading role to influence regional centers in their research efforts. However, if we compare our epidemiologic papers to Western papers, usually they are controlled studies or randomized studies. We are not at this stage yet in China. We may be there in five or ten years, but for the time being we feel working with epidemiological studies is a good progress, since our resources are limited and this is a big country. The population and clinical workload is enormous, and the resources for studies are limited, so we feel that this is a practical approach for us to investigate and implement technologies.”

“Some things in China are very different yet compared to the West. The neonatal aspect of premature newborns in China is different; we have a very low premature birth-rate below gestational age of 28 weeks, a very small proportion even in the countryside data and in cities. For the general population in China, when developing the neonatal care program, we need to put the major focus and
in a very short period of time. The NICU staff members have also expanded their horizons with an International Training Program in Neonatal-Perinatal Medicine in Shanghai in joint venture with the Canadian Neonatal Network and the Canadian Pediatric Society. The objectives of the program are to establish a national training center for neonatal medicine in Shanghai, which will train a new generation of neonatologists within the PRC, to establish national standards of care and training of neonatologists and other caregivers in neonatology in the PRC, and to provide new areas for joint collaboration in the future.

The training program has already influenced ventilation therapy within the NICU. Neonatologist Dr Jin Wang explains: “For invasive ventilation in pre-term infants, Synchronized Intermittent Mandatory Ventilation (SIMV) is most frequently used, and we used Pressure Regulated Volume Control (PRVC) plus Volume Control on some occasions as well. We use SIMV with Pressure Control. Some of the spontaneously breathing babies are given SIMV with Pressure Support. Several years ago we were just using Pressure Control and sedation, but we switched to SIMV after the training program in Canada where this mode was taught. This change occurred a few years ago.”

Neonatologist Dr Wenjin Shi further described the program: In our cooperation with Canada, the training program is a two year program. In the first year the respiratory therapists and neonatologists came from Canada to our center for the initial education. From there we applied to different hospitals in Canada for a one year training program. There are different hospitals and centers in Canada, but they are all university hospitals that participate and provide the collaboration with us.”

Neonatologist Dr Rong Zhang described how the area of leakage was addressed in the NICU, and the weaning process and average time to extubation for most babies: “We try to insert the endotracheal tube properly from the beginning, and we position the baby as a means to minimize leakage. We usually don’t use leakage syndrome and respiratory failure. We consider that we are catching up and will be using more advanced technology, but we must consider our general situation in a pragmatic manner to find our best solutions to reach our targets.”

**Developments in standards of care and training**

The Neonatal Intensive Care Unit of the Shanghai Children’s Hospital of Fudan University Hospital has rapidly expanded in recent years; moving to a newly constructed facility has allowed the unit to grow from a 40 bed facility for neonates to 150 neonatal patients effort within neonatal intensive care by not judging on the size of the babies that are delivered, rather systematically focus on the patients with the birth weights of 1,000 or 1,500 grams instead of the extremely premature low birth weight infants. We must systematically study this patient group to establish where we are, before attempting major resources and efforts in the more uncommon patient group. For instance, this is a national center and ten years ago this facility was the same size as the centers in provincial cities that I travel to now. You can clearly see the trend of the development. In our own clinic the mortality rates are becoming closer to a mid-level or the Western level of mortality in terms of respiratory distress.
compensation, but we need to learn more and become familiar with other methods as well. In terms of weaning, it all depends if the pressure is high. If we see that the pressure levels have become lower and if oxygenation is good, we start to wean the baby by monitoring pressure and rate. Usually the mean airway pressure is less than 18 by that time.”

Surfactant therapy is used within the NICU for very distinct situations.

Neonatologist Dr Lin Yuan explains: “If there is an x-ray showing signs of neonatal respiratory distress syndrome and if the baby’s oxygen requirement is more than 30 or 40% we give surfactant. We do admit many babies from other centers that have had a dose of surfactant prior to being admitted here.”

NICU Chief Dr Chao Chen described his opinion of the biggest challenges in mechanical ventilation in neonates: “I think the biggest challenge is and will continue to be infection control, and a risk of infection with invasive ventilation, the neonatal lung is so sensitive. We have 40 to 50 nurses in this NICU, with 2 attending neonatologists that are always on staff as well as 12 residents, 2 chief fellows and myself as chief physician. Infection control remains as our number one priority and concern, even with the rapid development and expansion we have experienced in recent years”.

### Biography

Bo Sun, MD, PhD received his initial medical degree in 1983 from the Faculty of Medicine and Pediatrics, Shanghai Second Medical University. His advanced graduate training during the years of 1983 – 1987 was at the Division of Pediatric Pathology, Department of Pediatrics, Children’s Hospital of Shanghai Medical University. Bo Sun received research fellowships from the Swedish Heart-Lung Foundation and the Karolinska Institute during 1987-1993, where he was a visiting research fellow at the Division of Experimental Perinatal Pathology at the Institute of Pediatrics at St. Göran’s Hospital in Stockholm and the Karolinska Institute, in Professor Bengt Robertson’s surfactant research program, and received a degree of Doctor of Medical Science (PhD). Later on, he developed a long term collaborative research and educational program with doctors and nursing experts in Sweden and European neonatal and pediatric intensive care communities, in promoting advanced respiratory care in newborns and infants in China.

Bo Sun is currently Head of Laboratory of Pediatric and Respiratory and Intensive Care Medicine at Children’s Hospital, Fudan University, Shanghai, China. He is also a Chair Professor in Pediatrics of the Ministry of Education and Fudan University, supported by research grants from National Natural Science Foundation, Ministry of Education and Shanghai Municipality, and with international collaboration from Sweden, Germany, Canada and the U.S. He is also active in major international neonatal and pediatric intensive care societies, and serving as international member of the journal editorial board of Acta Paediatrica, Neonatology, Pediatric Critical Care Medicine, Pediatric Research and Early Human Development.

### References


